



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
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DRINKING WATER STANDARDS AND HEALTH ADVISORIES TABLE

FEBRUARY 2004

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The USEPA Region 9 Drinking Water Standards and Health Advisories Table is a compendium of standards, health advisories and related information for chemicals and other contaminants which may be found in ground and surface waters. It provides a comprehensive listing of all current and proposed National Primary Drinking Water Regulations (NPDWRs), additional Maximum Contaminant Levels (MCLs) specific for California, Arizona and Hawaii, and California Drinking Water Action Levels. Where available, it includes USEPA Integrated Risk Information System (IRIS) cancer risk levels and oral reference dose (RfD) values, and USEPA Office of Ground Water and Drinking Water (OGWDW) Health Advisories for drinking water contaminants.

In order to make this table a manageable size, very few explanations or caveats for the values are included in the body of the table. Because of this, and the fact that background documentation and understanding of the derivation of specific values are critical to the proper use of this information, this table should not be used as a sole source of information for decision making. While the Appendix contains brief explanations of the different standards, criteria and advisories, consideration must be given to the context in which these numbers will be used. The appropriate reference materials should be consulted to determine the applicability of the number being considered. Some references are listed in the Appendix.

The values in this table are current to the publication date, but are subject to change. The user is advised to contact Bruce Macler, Drinking Water Toxicologist, USEPA Region 9, at (415) 972-3569, if questions arise regarding current values. Additional information is available from USEPA's Office of Science and Technology. The web site for this Office is: www.epa.gov/ost/drinking/standards. Regulations appear at: www.epa.gov/safewater.

INFORMATION IN THIS TABLE

The information for specific contaminants in this table is arranged by contaminant type. For each contaminant, any applicable or proposed USEPA National Primary Drinking Water Regulation is listed. These include the enforceable **Maximum Contaminant Levels (MCLs)**, the health-based, but not enforceable **Maximum Contaminant Level Goals (MCLGs)**, and the aesthetics-based **Secondary MCLs**. A given contaminant may have both a MCL and a Secondary MCL, as well as a MCLG. The regulatory status of these standards is indicated. **Proposed MCLs or MCLGs** have been formally proposed by USEPA, but not promulgated. **Final MCLs or MCLGs** have been promulgated, but are not yet effective as of the publication date. The effective date, if available, is indicated. **Current MCLs or MCLGs** are promulgated and in effect.

In addition to regulatory information, health risk information is provided in the table. Data from IRIS for cancer and non-cancer health effects associated with drinking water contaminants is listed. The **RfD (Reference Dose)** is the daily oral intake (on a body weight basis) that is below the level USEPA believes to be without adverse, non-cancer health risks (i.e., zero risk). The **IRIS 10⁻⁶ risk level** is that contaminant concentration (in ug/liter) in drinking water that would yield no greater than an additional risk of one-in-a-million (10⁻⁶) after a lifetime of drinking that water. The USEPA OGWDW Health Advisories provide information on acceptably safe levels of exposures to contaminants in drinking water. The **Acute 10-day** values apply specifically to acute toxic effects on children, but are expected to be protective for adults. The **chronic (lifetime)** values for non-cancer health effects should be protective of

health even with a lifetime exposure. For non-carcinogenic chemicals, this value is typically the same as the MCLG, if one has been established. The chronic (lifetime) values for cancer are set at a level that should yield no greater than an additional 10^{-6} risk over a lifetime exposure.

EPA has recently changed its approach to determining carcinogenicity of chemicals to allow a fuller consideration of the many factors involved in the development of cancer. The Agency is beginning the process of reevaluating all the chemicals previously classed as to their carcinogenicity. However, few are yet available. The following **cancer weight of evidence** determinations are thus now no longer done, but have yet to be changed and are therefore listed to provide additional information on EPA's judgement of carcinogenicity for each chemical. These (old) weight of evidence classifications are as follows:

- A** known human carcinogen
- B1** probable human carcinogen based on human data
- B2** probable human carcinogen based on animal data
- C** possible human carcinogen based on animal data
- D** insufficient data to classify chemical
- E** not a human carcinogen

APPLICABILITY AND USES OF THIS TABLE

The different types of standards and advisories contained in this table are based upon approaches and assumptions that are specific to each and consequently may have varying applications depending on their derivation. Use of specific types of information should be guided by the relevant legal requirements and an understanding of the meaning of the information itself.

MCLs and treatment techniques are the only federally enforceable NPDWRs for drinking water systems. They are set to be health protective as well as feasible, and take into account analytical and treatment limitations. More stringent state-specific MCLs are enforceable in the indicated state. MCLGs, based solely on health information, are not enforceable, but provide health-based guidance for decision making. MCLGs for chemicals causing non-carcinogenic health effects are based on the RfD and set at a level believed to be safe. MCLGs for chemicals believed to be carcinogens are generally set at zero, from the perspective that no level of carcinogen is safe. Non-zero carcinogen MCLGs can be established with adequate documentation, although none has been done to date. Feasibility is not considered in setting MCLGs. Secondary MCLs are not enforceable, but provide information on aesthetics and palatability.

Health advisories and criteria are not formally promulgated in regulations and are subject to change as new data and analyses become available. MCLGs, values in IRIS and health advisories are developed by different EPA Offices and on different schedules. Therefore, values for similar effects from a given chemical may not be consistent throughout the table. The derivations of MCLGs and chronic (lifetime) health advisories for non-carcinogenic chemicals are based on the same assumptions regarding endpoints of toxicity. Slight differences in the table are due to rounding of numbers by different offices.

When considering a value to use for determining an acceptable level of contaminant in drinking water, the MCL should be selected first. In the absence of existing or proposed MCLs, users may have to decide which criteria are most appropriate. USEPA recommends a priority ranking to first consider any proposed MCLG (if other than zero), followed by the IRIS RfD or

cancer risk level, and finally the chronic health advisory values.

Under the **Superfund Program**, remedial actions must comply with the **Applicable or Relevant and Appropriate Requirements (ARARs)**. For actions involving contamination of drinking water supplies, the ARARs under the Safe Drinking Water Act are typically the MCLs. Where there are no MCLs, or where the MCLs are determined to be insufficiently protective because of multiple contaminants, reference should be made to Superfund guidance documents to determine clean-up policy. For remedial actions impacting aquatic organisms and waters regulated under the Clean Water Act, consult the National Ambient Water Quality Criteria (NAWQC).

DESCRIPTIONS OF STANDARDS AND ADVISORIES

Authority

Under the authority of the Safe Drinking Water Act (SDWA, Public Law 93-523), the USEPA is mandated to establish National Primary Drinking Water Regulations for contaminants occurring in drinking water. Primary NPDWRs are established and enforced to protect the public from adverse health effects resulting from a drinking water contaminant. Included in these regulations are the drinking water standards which set either 1) treatment techniques to control a contaminant, or 2) the Maximum Contaminant Level (MCL) allowable for the contaminant in drinking water. A MCL is set when an appropriate method of detection for the contaminant exists. A treatment technique approach is used when it is not possible to quantify the contaminant at the level necessary to protect public health. Secondary standards are established based on non-health related aesthetic qualities of appearance, taste and odor. These secondary standards are not federally enforceable. In California, SMCLs are enforceable at the request of a community.

States may choose to accept responsibility (Primacy Status) for the oversight and enforcement of US drinking water regulations. States which have primacy status from USEPA must adopt State drinking water standards that are at least as stringent as federal standards. A state may choose to enforce secondary standards as well as primary standards.

USEPA Maximum Contaminant Level Goals (MCLGs)

MCLGs are developed by the Office of Science and Technology in the USEPA Office of Water as a required first step toward promulgation of NPDWRs. MCLGs are non-enforceable health goals which are to be set at levels at which no known or anticipated adverse effects on the health of persons occur, and which allow for an adequate margin of safety. Prior to the SDWA Amendments of 1986, these levels were called Recommended Maximum Contaminant Levels (RMCLs). MCLGs are strictly health-based levels and are derived from relevant toxicological data.

For chemicals that produce adverse health effects and are not believed to be carcinogenic (non-carcinogens), the MCLG is based on the Reference Dose (RfD)(see additional discussion below. A RfD is calculated from toxicological data to represent a contaminant level that should be without risk of adverse health effects even with a lifetime exposure. USEPA assumes that a threshold exists for non-cancer health effects from chemical contaminants, below which the effect will not occur. Thus the MCLG will be a non-zero number. The RfD, which is based on the total daily amount of contaminant taken up by a person on a body weight basis, is converted to a Drinking Water Equivalent Level (DWEL) concentration and adjusted for the percentage

contribution of other sources (relative source contribution, RSC) of the contaminant besides drinking water (air, food, etc) to arrive at the MCLG. This calculation assumes a lifetime consumption of two liters of drinking water per day by a 70 kg adult. Unless otherwise noted, the RSC from drinking water for organic and inorganic compounds is respectively 20% and 10%.

USEPA Office of Water uses a default assumption that no threshold exists for cancer initiation and thus, there is no absolutely safe level of exposure. USEPA has recently revised its process for evaluating the carcinogenicity of chemicals to consider possible effect thresholds for some carcinogen types. However, as of this date, no previously classified chemical has been reclassified using this approach. Until such time as this occurs, classifications under the older approach are still used for management purposes. For chemicals that are known (old Group A) or probable (old Group B) human carcinogens, USEPA policy directs that the MCLG be set at zero, in accordance with a recommendation by the US Congress. For contaminants believed to be possible human carcinogens (old Group C), the MCLG may be derived based on relevant non-cancer health effects as described above. In this case, the RfD is divided by an additional uncertainty factor of 10. In some cases, Group C chemicals will have MCLGs set based on calculated maximum lifetime cancer risks of between 1/10,000 and 1/million.

Maximum Contaminant Levels (MCLs)

MCLs are federally enforceable limits for contaminants in drinking water established as NPDWRs. The MCL for a given contaminant is set as close to the corresponding MCLG as is feasible. "Feasible" is defined in the 1986 SDWA Amendments as "feasible with the use of the best technology, treatment techniques and other means which the Administrator finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are available (taking cost into consideration)." This has been amplified in the 1996 SDWA Amendments to require EPA to consider feasibility with respect to smaller drinking water systems as well. To promulgate a MCL for a contaminant requires that a method of detection for that contaminant is available suitable for the level desired and Best Available Technologies are identified that can feasibly remove the contaminant to the desired level.

Secondary Maximum Contaminant Levels

Secondary MCLs are established under the SDWA to protect the public welfare. Such regulations apply to contaminants in drinking water that adversely affect its odor, taste or appearance and consequently cause a substantial number of persons to discontinue its use. Secondary MCLs are not based on direct adverse health effects associated with the contaminant, although some contaminants may have both a MCL and a SMCL. SMCLs are considered as desirable goals and are not federally enforceable. However, states may choose to promulgate and enforce SMCLs at the state level.

Health Advisories

Health Advisories (HAs) for drinking water contaminants are levels considered to be without appreciable health risk for specific durations of exposure. HAs should be considered guidance and are not enforceable drinking water standards.

USEPA HAs are developed and published initially as External Review Drafts, and then as a Final Draft. This designation indicates that the HA will be always subject to change as

additional information becomes available. HAs are developed for one-day, 10-day, longer-term (approximately 7 years) and lifetime (70 year) exposures based on data describing non-carcinogenic health effects resulting from the contaminant. One-day and 10-day HAs use parameters which reflect exposures and effects for a 10 kg child consuming 1 liter of water per day. Lifetime HAs consider a 70 kg adult consuming 2 liters of water per day. Longer-term HAs can incorporate either child or adult parameters. A relative source contribution from water is also factored into the lifetime HA calculation to account for exposures from other sources (air, food, soil, etc) of the contaminant.

For known or probably human carcinogens, the lifetime HA level is based on an upper-bound excess lifetime cancer risk of 1/million. This means that USEPA considers that the risk from a lifetime consumption of water at the given level is unlikely to be greater than 1/million, is most likely substantially less and may be zero.

Reference Dose (RfD) and Drinking Water Equivalent Level (DWEL)

The RfD is a daily exposure level which is believed to be without appreciable health risk to humans over a lifetime. The RfD is usually derived from an experimental "no observed adverse effect level" (NOAEL), identified as the highest dose in the most relevant study that did not result in a known adverse effect. The NOAEL is divided by various uncertainty factors to derive the RfD. These uncertainty factors account for the variation in human response, extrapolation to human responses if animal experiments were used, data quality and relevance. The RfD takes the form of dose ingested per unit body weight per day (ug/kg-d).

The DWEL is the conversion of the RfD into an equivalent water concentration. It assumes that a 70 kg adult consumes two liters of water per day and that the total dose to a person results solely from drinking water. It is important to remember that actual exposures in the environment may occur through other routes, such as inhalation or dermal contact, or from other sources, such as from food or soil.

California Action Levels

California Department of Health Services Action Levels are health-based criteria derived much in the same way as EPA Health Advisories. Specific approaches to determining cancer risks and exposure assumptions may differ in some ways from those used by USEPA. California Action Levels are not enforceable drinking water standards, but are levels at which CA DOHS strongly urges water purveyors to take corrective action to reduce the level of contamination in the water they supply. Action Levels cease to exist when CA State MCLS are promulgated. The CA DOHS web site is "www.dhs.ca.gov/ps/ddwem".

Integrated Risk Information System (IRIS)

IRIS is an EPA catalogue of Agency risk assessment and risk management information for chemical substances. It is available electronically in several formats. The risk assessment information contained in IRIS, unless specifically noted, has been reviewed and agreed upon by intra-agency work groups and represents Agency consensus. Chemical contaminants listed in IRIS may have descriptions of relevant toxicological experiments and risk assessment approaches used in the determination of RfDs, cancer risks and health advisories. Extensive bibliographies are included. Regulations and regulatory status for different media may be presented. The IRIS web site is "www.epa.gov/iris".

REFERENCES

EPA National Primary Drinking Water Regulations (NPDWRs): Code of Federal Regulations, Title 40, Part 141

Specific NPDWRs, including supporting information:

NPDWRs; Synthetic Organic Chemicals, Inorganic Chemicals and Microorganisms; Proposed Rule: FR 50, n. 219, November 13, 1985. (Phase I contaminants.)

NPDWRs; Volatile Synthetic Organic Chemicals, Final Rule and Proposed Rule: FR 50, n. 219, November 13, 1985. (Phase I chemicals.)

NPDWRs; Fluoride; Final Rule and Proposed Rule: FR 50, n. 220, November 14, 1985.

NPDWRs; Fluoride; Final Rule: FR 51, n. 63, April 2, 1986.

NPDWRs; Volatile Organic Chemicals; Final Rule: FR 52, n. 130, July 8, 1987. (Phase I chemicals.)

NPDWRs; Filtration and Disinfection; Turbidity, Giardia lamblia, Viruses, Legionella, and Heterotrophic Bacteria; Proposed Rule: FR 52, n. 212, November 3, 1987.

Drinking Water; NPDWRs; Total Coliforms; Proposed Rule: FR 52, n. 212, November 3, 1987.

Drinking Water Regulations; MCLGs and NPDWRs for Lead and Copper; Proposed Rule: FR 53, n. 160, August 18, 1988.

NPDWRs, Proposed Rule: FR 54, n. 97, May 22, 1989. (Phase II inorganics, VOCs, SOCs.)

Drinking Water; NPDWRs; Filtration, Disinfection; Turbidity, Giardia lamblia, Viruses, Legionella, and Heterotrophic Bacteria; Final Rule: FR 54, n. 124, June 29, 1989.

Drinking Water; NPDWRs; Total Coliforms (Including Fecal Coliforms and E. coli); Final Rule: FR 54, n. 124, June 29, 1989.

NPDWRs; Synthetic Organic Chemicals and Inorganic Chemicals; Proposed Rules: FR 55, n. 143, July 25, 1990. (Phase V chemicals.)

NPDWRs, Final Rule: FR 56, n. 20, January 30, 1991. (Phase II inorganics, VOCs, SOCs.)

NPDWRs, Proposed Rule: FR 56, n. 20, January 30, 1991. (Aldicarb, Aldicarb Sulfoxide, Aldicarb Sulfone, Pentachlorophenol, Barium.)

MCLGs and NPDWRs for Lead and Copper; Final Rule. FR 56, n.110, June 7, 1991.

NPDWRs; Final Rule. FR 56, n.126, July 1, 1991. (Aldicarb, Aldicarb Sulfoxide, Aldicarb Sulfone, Pentachlorophenol, Barium.)

NPDWRs; Radionuclides; Proposed Rule. FR 56, n.138, July 18, 1991.

NPDWRs; Synthetic Organic Chemicals and Inorganic Chemicals; Final Rule. FR 57, n.138, July 17, 1992. (Phase V chemicals.)

NPDWRs; Disinfectants and Disinfection Byproducts; Proposed Rule. FR 59, n.145, July 29, 1994.

NPDWRs; Enhanced Surface Water Treatment Requirements; Proposed Rule. FR 59, n.145, July 29, 1994.

NPDWRs: Disinfectants and Disinfection Byproducts; Notice of Data Availability; Proposed Rule. FR 62, n.212, November 3, 1997.

Announcement of the Drinking Water Contaminant Candidate List; Notice. FR 63, n.40, March 2, 1998.

NPDWRs: Disinfectants and Disinfection Byproducts Notice of Data Availability; Proposed Rule. FR 63, n.61, March 31, 1998.

NPDWRs: Interim Enhanced Surface Water Treatment; Final Rule. FR 63, n.241, December 16, 1998.

NPDWRs: Disinfectants and Disinfection Byproducts; Final Rule. FR 63, n.241, December 16, 1998.

NPDWRs; Radon-222; Proposed Rule. FR 64, n.211, November 2, 1999.

NPDWRs: Long Term 1 Enhanced Surface Water Treatment and Filter Backwash Rule; Proposed Rule. FR 65, n.69, April 10, 2000.

NPDWRs: Ground Water Rule; Proposed Rules. FR 65, n. 91, May 10, 2000.

NPDWRs; Radionuclides; Final Rule. FR 65, n.236, December 7, 2000.

NPDWRs; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring; Final Rule. FR 66, n. 14, January 22, 2001.

NPDWRs: Filter Backwash Recycling Rule; Final Rule. FR 66, n. 111, June 8, 2001

NPDWRs: Long Term 1 Enhanced Surface Water Treatment Rule; Final Rule. FR 67, n.9, January 14, 2002.

FDA STANDARDS FOR BOTTLED WATER

The U.S. Food and Drug Administration is responsible for regulating bottle water quality. It is required to adopt health-protective allowable limits for bottled water based on NPDWRs. Regulations governing bottled water can be found in Code of Federal Regulations Title 21, Parts 129 and 165. FDA has adopted these MCLs:

Barium	Dibromochloropropane	o-Dichlorobenzene
Cadmium	2,4-D	p-Dichlorobenzene
Chromium	Ethylene dibromide	cis 1,2-Dichloroethylene
Mercury	Heptachlor	trans 1,2-Dichloroethylene
Nitrate	Heptachlor epoxide	1,2-Dichloropropane
Nitrite	Lindane	Ethylbenzene
Selenium	Methoxychlor	Monochlorobenzene
Alachlor	Pentachlorophenol	Styrene
Atrazine	PCBs	Tetrachloroethylene
Carbofuran	Toxaphene	Toluene
Chlordane	2,4,5-TP (Silvex)	Xylenes

Allowable limits based on Secondary MCLs apply for aluminum and silver. In addition, bottled water must not exceed 5 ug/L lead and 1 mg/L copper.

DRINKING WATER CONTAMINANT CANDIDATE LIST (1998)

Microbiological contaminants

Acanthamoeba (guidance expected for contact lens wearers)
Adenoviruses
Aeromonas hydrophilia
Caliciviruses
Coxsackieviruses
Cyanobacteria (blue-green algae), other freshwater algae, and their toxins
Echoviruses
Helicobacter pylori
Microsporidia (Enterocytozoon and Septata)
Mycobacterium avium intracellulare (MAC)

Chemical contaminants

1,1,1,2-tetrachloroethane
1,2,4-trimethylbenzene
1,1-dichloroethane
1,1-dichloropropene
1,2-diphenylhydrazine
1,3-dichloropropane
1,3-dichloropropene
2,4,6-trichlorophenol

2,2-dichloropropane
2,4-dichlorophenol
2,4-dinitrophenol
2,4-dinitrotoluene
2,6-dinitrotoluene
2-methylphenol (o-cresol)
Acetochlor
Alachlor ESA and other acetanilide pesticide degradation products
Aldrin
Aluminum
Boron
Bromobenzene
DCPA mono-acid degradate
DCPA di-acid degradate
DDE
Diazinon
Dieldrin
Disulfoton
Diuron
EPTC (s-ethyl-dipropylthiocarbamate)
Fonofos
Hexachlorobutadiene
p-Isopropyltoluene (p-cymene)
Linuron
Manganese
Methyl bromide
Methyl-t-butyl ether (MTBE)
Metolachlor
Metribuzin
Molinate
Naphthalene
Nitrobenzene
Organotins
Perchlorate
Prometon
RDX
Sodium
Sulfate
Terbacil
Terbufos
Triazines and degradation products of triazines (including, but not limited to, cyanazine and atrazine-desethyl)
Vanadium